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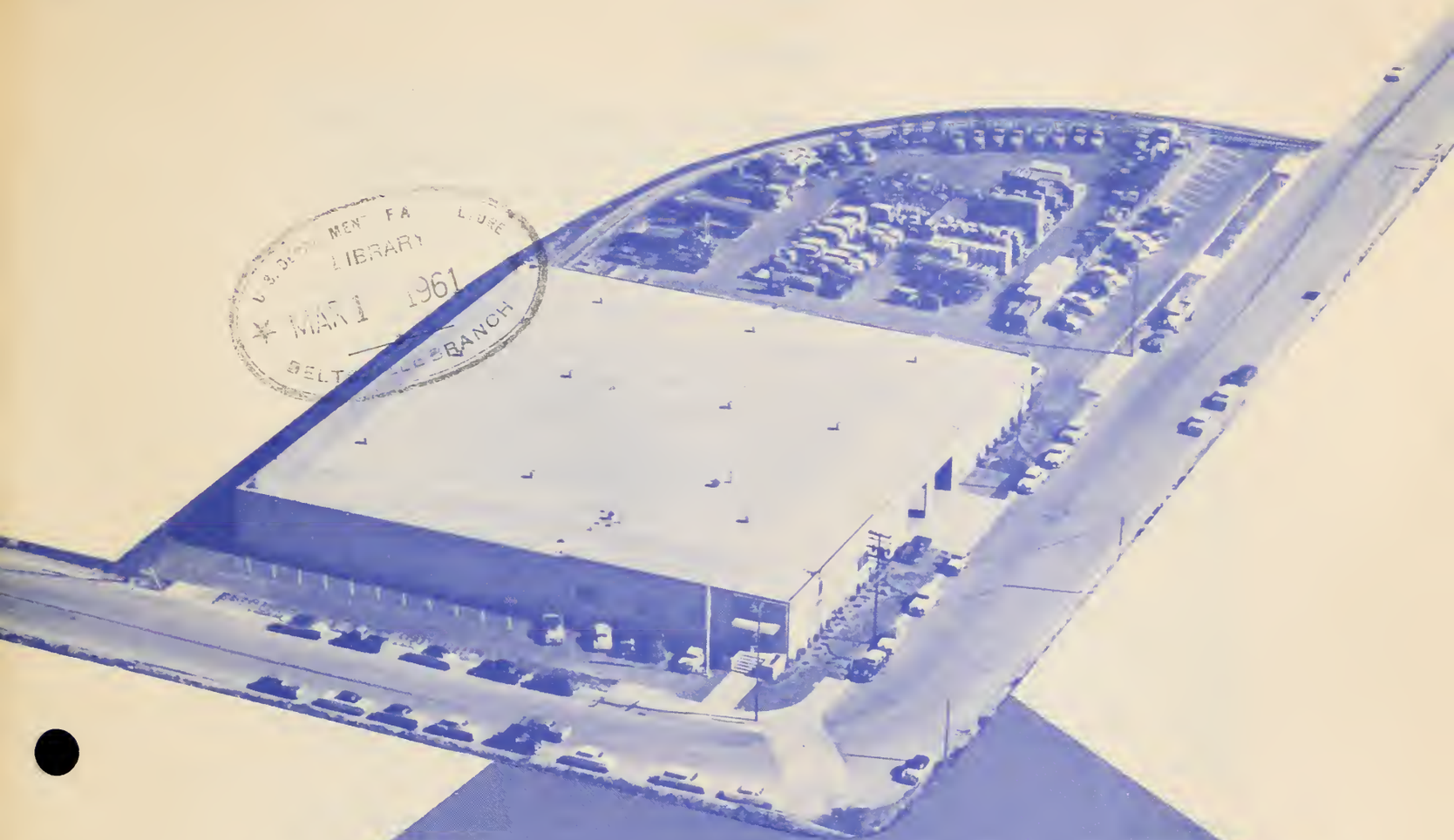

guide for WAREHOUSING USDA-donated foods

Agricultural Marketing Service
U. S. DEPARTMENT OF AGRICULTURE

PREFACE

This handbook is designed to guide distributing agencies in the proper method of handling and warehousing USDA-donated foods which are available to State agencies for distribution to schools, charitable institutions, needy persons, and other eligible recipients.

The information presented here has been drawn from many sources and includes findings from the latest research on handling and storing the various foods being distributed. This material has been assembled to acquaint distributing agencies with the types of warehouses, storage facilities, and equipment needed for handling and storing USDA-donated foods.

In using this guide, consider the geographic location of the warehouse and local situations prevailing in the area, with particular attention given to climatic conditions.

In many instances, food losses resulting from deterioration and infestation are the result of inadequate storage facilities, undesirable handling practices, and other conditions which may be corrected by following the preventive and control measures outlined in this handbook. The information presented herein is also applicable to the handling and warehousing of locally-purchased foods.

Agencies that accept USDA-donated foods also accept the responsibility to store and handle them properly. Failure to do so may result in the Department withholding further donations of foods or requiring restitution for foods that are lost or become spoiled.

Prepared by the Food Distribution Division
in cooperation with the Marketing Research Division,
Agricultural Marketing Service

Cover photograph shows the warehouse of the
California Department of Education
at San Leandro, California

DN-1332

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INTRODUCTION

All USDA-donated foods are of good quality, and are purchased on a specific grade under USDA inspection. Therefore, careful consideration must be given to the selection of storage warehouses to make sure that foods offered or requested for distribution are stored in such a way as to maintain their high quality and nutritive value.

The term "warehouse" applies to any facility where foods are received and held in storage for later distribution.

Two types of warehouse facilities are needed: *dry* and *refrigerated.* Their adequacy may be measured by the extent to which these facilities attain the following objectives:

PROTECTION OF FOODS—This involves consideration of the type of building needed; temperature, humidity, and ventilation; safeguarding from theft; and damage by the elements, fire, insects, rodents, spoilage organisms, or other causes.

CONTROL OF FOODS—This involves the maintenance of inventory records and the arrangement of the foods so that their identity, location, and the quantity on hand may be readily determined.

CONSERVATION OF SPACE AND LABOR—This involves the optimum use of storage aids and equipment consistent with the storage and handling methods that are practicable within the limitations of space, labor, and funds available.

Location of Warehouse

Dry and refrigerated warehouse facilities should be conveniently located near each other, preferably in the same building. The facilities should be located adjacent to a railroad siding with ample docks to assure prompt handling of inbound and outbound shipments by railroad cars and/or trucks.

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Figure 1.—Warehouse showing railroad siding.

N–23970

Figure 2.—Warehouse showing truck docks.

Storage Space

Care should be exercised when selecting or constructing warehouse facilities for storing USDA-donated foods to determine their adequacy for the type of food to be stored, and the space required for the volume to be handled.

The amount of floor space needed should be determined by the volume and type of food to be stored and the floor load capacity. Sufficient floor space should be provided to permit ease of inspection, inventory, and removal of foods.

General Structural Features

To insure protection of foods from the elements and from extreme temperature changes, the warehouse should be tightly constructed; water-proof; rodent- and insect-proof; well-ventilated; and if necessary, insulated. Provision should be made for sanitary handwashing and restroom facilities for the warehouse personnel.

The floors should be smooth to facilitate the use of hand-and/or mechanically-powered trucks in handling foods, and strong enough to bear the weight of the foods. The safe floor load capacity should be determined or approved by a State or local safety engineer or building inspector before the warehouse is accepted or approved for use.

All windows and outside doors should be screened to prevent entrance of rodents and insects. To prevent theft, all accessible windows should be covered with strong bars, and doors protected with bar locking devices. To protect foods from direct sunlight, use opaque paint on the windows. Sufficient light, either natural or artificial, should be provided to insure safe and efficient operation. Poor light contributes to unsatisfactory warehousing conditions generally. Wiring for artificial lighting should comply with National Electrical Code requirements (an American Standard) together with other local requirements.

Good visibility in the storage area makes it easier for employees to locate stock, and it also eases the job of accurately checking paper work associated with receiving or shipping foods. In order to provide adequate lighting for the storage area, illumination levels of approximately 25 to 30 foot-candles are desirable. This is normally achieved by providing about 3 watts per square foot of floor area.

Similar illumination levels in aisles and dock areas improve traffic safety, particularly where materials-handling equipment moves rapidly. The increased visibility provided by adequate illumination tends to reduce errors in judgment that may lead to collisions or other mishaps. Good lighting contributes to better housekeeping by employees, and greater pride in the working conditions as a result. When deep shadows are eliminated and illumination is fairly uniform, it is easier to see areas that require maintenance. Experience shows that employees will keep working areas cleaner and neater under these conditions.

Usually, the best solution for providing the desired illumination (25 to 30 foot-candles) involves the use of fluorescent lamps. For best distribution of illumination, it is desirable to have a row of fixtures over each aisle. Satisfactory results can usually be obtained by mounting industrial type two-lamp reflectors end-to-end in the rows. The fixtures should be high enough to comfortably clear the highest reach of loaded materials-handling equipment.

Large warehouses should be equipped with burglar alarm and sprinkler type fire protection and alarm systems. Small warehouses should have power- or hand-operated fire extinguishers available. This equipment should be inspected regularly and kept in usable condition.

Dry Food Storage Facilities

Good ventilation in the dry food storage area is essential. By assisting in controlling the temperature and humidity, ventilation retards growth of various types of bacteria and molds, prevents mustiness and rusting of metal containers, and minimizes the caking of ground or powdered foods. Reliable thermometers should be provided to indicate what temperatures prevail in the storage area.

It is desirable to maintain a temperature of 50° to 70° F. in the dry food storage area. In cooler climates, this temperature can usually be held by proper insulation and by natural and/or mechanical ventilation. Natural ventilation is obtained by proper construction of the warehouse to permit entrance of fresh cool air through louvers at the floor level and the escape of warm air through louvers at the ceiling or roof level. Mechanical, or forced air ventilation, with intake and/or exhaust fans, keeps fresh air circulating.

In hot, humid climates, where temperatures of 50° to 70° F. cannot be maintained by natural or mechanical ventilation and humidities are consistently high (over 80 percent), it may be necessary to install artificial refrigeration to keep the temperature from going above 70° F. If this facility cannot be provided, a dehumidifier will be of some help. During the winter months when temperatures may drop below freezing, it may be necessary to use heating equipment to keep certain foods from freezing.

Refrigerated Food Storage Facilities

Two types of refrigerated storage space are needed:

Normal refrigeration, maintained at a temperature of 32° to 50° F.;

"Freezer" or frozen food storage, maintained at 0° F. or below.

A refrigerated storage space can be any artificially cooled, properly insulated room, or series of rooms in a warehouse where the desired temperature and humidity can be maintained by the use of refrigeration units. It may be desirable to partition off and insulate a section of the dry food storage area and to install an air-conditioning unit. If this is not practical, a separate room or a series of rooms may be used for this purpose. Humidities in refrigerated storage areas may range from 65 to 90 percent, depending on the requirements of the food. In "freezer" storage areas, humidity is less critical especially if the frozen food is well packaged. But, even here, it is essential to have rather high humidities to prevent excessive moisture loss.

An auxiliary refrigeration unit should be available and ready for use to maintain proper temperatures in an emergency, particularly with respect to frozen food storage. All refrigeration units must meet State and local building codes and inspection requirements for refrigerated storage areas. Reliable thermometers should be provided.

Elevations in temperatures above the ideal should be kept to a minimum. *The quality of both fresh and frozen food is adversely affected by exposure to temperatures above the ideal.* Recording thermometers should be installed in the refrigerated food storage area to give a continuous record of temperatures.

General Guides for Storing USDA-Donated Foods

This table, based on current research findings, is a *general guide* for storing various USDA-donated foods. It includes all foods that have been offered from time to time by the U. S. Department of Agriculture for distribution to schools, institutions, needy persons, and other eligible recipients. For more specific information on temperature requirements

and other storage guidelines see the fact sheets issued by the U. S. Department of Agriculture to the State Distributing Agencies.

As used in these tables, "satisfactory" means this type of storage is acceptable. "Preferred" means this type of storage will maintain quality of the product for a longer period of time. "Required" means that this type of storage is essential—there is no alternative to it.

Food	Dry Storage (50°–70° F.)	Refrigerated Storage (32°–50° F.)	Freezer Storage (0° F. or below)
DAIRY PRODUCTS			
Butter		Satisfactory up to 2 weeks (maximum 45° F.).	Required over 2 weeks.
Cheese, Natural		Required (maximum 45° F.).	
Cheese, Processed		Required (maximum 45° F.).	
Milk, Nonfat Dry	Satisfactory	Preferred	
EGGS			
Shell Eggs		Required	
Dried Eggs		Required	
MEAT AND MEAT PRODUCTS			
Bacon		Required	
Beef, Ground, Frozen			Required.
Beef & Gravy, Canned	Satisfactory	Preferred	
Hams & Shoulders, Cured.		Required	
Hams & Shoulders, Cured, Frozen.			Required.
Hams, Canned		Required	
Pork Loins, Frozen			Required.
Pork Luncheon Meat, Canned.	Satisfactory	Preferred	
Pork & Gravy, Canned	Satisfactory	Preferred	
Turkeys, Frozen			Required.
FATS & OILS			
Cottonseed Oil	Satisfactory	Preferred	
Lard, Stabilized	Satisfactory	Preferred	
Olive Oil	Satisfactory	Preferred	
Vegetable Shortening	Satisfactory	Preferred	
CANNED VEGETABLES			
Beans, Green	Satisfactory	Preferred	
Beets	Satisfactory	Preferred	
Carrots	Satisfactory	Preferred	
Corn	Satisfactory	Preferred	
Peas, Green	Satisfactory	Preferred	
Tomatoes	Satisfactory	Preferred	
Tomato Paste	Satisfactory	Preferred	
Tomato Puree	Satisfactory	Preferred	
CANNED FRUITS			
Apples, Sliced	Satisfactory	Preferred	
Applesauce	Satisfactory	Preferred	

Food	Dry Storage (50°–70° F.)	Refrigerated Storage (32°–50° F.)	Freezer Storage (0° F. or below)
CANNED FRUITS—con.			
Apricots	Satisfactory	Preferred	
Cherries	Satisfactory	Preferred	
Cranberry Sauce	Satisfactory	Preferred	
Figs	Satisfactory	Preferred	
Grapefruit Sections	Satisfactory	Preferred	
Grapefruit Juice	Satisfactory	Preferred	
Orange Juice, Concentrate.		Required	
Peaches	Satisfactory	Preferred	
Purple Plums (Prunes)	Satisfactory	Preferred	
FRESH VEGETABLES			
Beans, Green		Required	
Beets		Required	
Cabbage		Required	
Carrots		Required	
Onions	Satisfactory	Preferred	
Potatoes, Irish	Satisfactory	Preferred (minimum, 40° F.)	
Spinach		Required	
Sweet Potatoes	Required (minimum 55° F.)		
FRESH FRUITS			
Apples		Required	
Peaches		Required	
Pears		Required	
Purple Plums		Required	
DRIED VEGETABLES			
Beans, High Moisture	Satisfactory for 60 days	Required over 60 days	
Beans, Low Moisture	Satisfactory	Preferred	
DRIED FRUITS			
Apples	Satisfactory for 2 weeks	Required over 2 weeks	
Apricots	Satisfactory for 2 weeks	Required over 2 weeks	
Figs	Satisfactory	Preferred	
Peaches	Satisfactory for 2 weeks	Required over 2 weeks	
Prunes	Satisfactory	Preferred	
Raisins	Satisfactory	Preferred	
CEREAL PRODUCTS			
Cornmeal, Regular	Satisfactory for 60 days	Required over 60 days	
Cornmeal, Degermed	Satisfactory	Preferred	
Flour, Whole Wheat	Satisfactory for 60 days	Required over 60 days	
Flour, All-purpose and Bread.	Satisfactory	Preferred	
Rice	Satisfactory	Preferred	
MISCELLANEOUS			
Honey	Satisfactory		
Nuts		Required	
Peanut Butter	Satisfactory	Preferred	

Protection of Foods from Odors

Foods which absorb odors should be segregated from those that give off odors. Below is a representative listing of typical foods that give off and/or absorb odors:

Food	Gives off odors	Absorbs odors
Apples, Fresh	Yes	Yes
Butter	No	Yes
Cabbage	Yes	No
Cheese	Yes	Yes
Cornmeal	No	Yes
Eggs, Dried	No	Yes
Eggs, Fresh Shell	No	Yes
Flour	No	Yes
Milk, Nonfat Dry	No	Yes
Onions	Yes	No
Peaches, Fresh	Yes	No
Potatoes	Yes	No
Rice	No	Yes

Do *not* store items such as paint, kerosene, gasoline, oils, naphthalene, soap, wax, polishes, etc. in the same area with foods. A separate storage room should be provided for such items.

Sanitation and Cleanliness

Good housekeeping practices should be followed to insure cleanliness and orderliness in all areas of the warehouse. Any foods dropped or spilled on the floor should be cleaned up immediately, since these foods invite rodent and insect infestation. All torn sacks, broken cartons, etc., should be removed from the warehouse and the product repackaged for immediate distribution. Empty containers and sacks should not be permitted to accumulate in the warehouse. Walls should be painted, calcimined, or whitewashed periodically. Floors should be swept and mopped regularly. The use of sweeping compound is recommended; if it is not available, the floor should be lightly sprinkled with water before sweeping. Restrooms should be cleaned and mopped daily. Hot and cold running water should be available. An adequate supply of soap and paper towels should be readily accessible for the use of employees.

Rodent and Insect Control

Rodents destroy or render unfit for human consumption enormous quantities of food each year. Rodents enter buildings through open doors, windows, and holes around pipes and wires. They frequently burrow under floors and enter through ventilation and drain pipes. Some are carried in with containers of food.

The most successful means of controlling rodents is prevention. All buildings where foods are stored should be rodent-proofed. All openings one-half inch or larger should be covered or sealed with one-fourth-inch-mesh galvanized hardware cloth or sheet metal. Fan and ventilation openings should be screened.

Insects also destroy or render unfit for human consumption enormous quantities of food each year. The following foods are susceptible to insect infestation:

Dried beans and peas
Grain products (flour, cornmeal, rice, cereals, etc.)
Dried fruits (prunes, raisins, apricots, etc.)
Nonfat dry milk
Cheese

There are many ways in which insect infestation may occur in a warehouse. Insects or insect eggs may be harbored in cracks in floors and walls of warehouses, in freight cars and trucks in which foods are transported, or in shipping containers, especially where the containers are reused without proper cleaning or fumigation. Insect infestation is evidenced by the presence of webbing, beetles, moths, larvae, holes in grain, or partly-consumed products. In bagged foods, insects are usually found in the creases of the bags, along seams, or in the ears of the bags. In cased foods, they may be found in the dark closed sections of the boxes.

Insect infestation may occur even under ideal warehouse conditions, therefore constant vigilance must be maintained for any sign of infestation, particularly during warm weather. Insect infestation of such foods as cornmeal, flour, beans, rice, dried fruits, and nonfat dry milk can be prevented by keeping these foods stored at temperatures below 50° F.

The most effective ways of eliminating and controlling both rodents and insects are by extermination and fumigation. Both of these services should be rendered by a reputable licensed company. The improper use of some fumigants may result in an explosion or a fire, or in ill effects to workmen from exposure to the chemicals used. Therefore, a fumigating company should be required to show evidence of public liability, property and fire insurance, and workmen's compensation. Since it is possible the first fumigation will not effect a 100 percent kill and may have to be followed with a second fumigation, a 100 percent kill guarantee should be included in any contract entered into with a fumigating company.

Major Points to Consider in Protection of Foods

Does the warehouse provide both dry and refrigerated storage facilities?

Is the warehouse conveniently located adjacent to a railroad siding with ample docks?

Is the storage space large enough and the floor strong enough to hold the quantity of foods to be stored?

Is the floor smooth enough to permit use of hand- and/or mechanically-operated trucks?

Is the warehouse free of holes in the floor or walls that would permit entry of rodents?

Is the warehouse free of cracks in the walls that might harbor insects?

Are the windows and doors screened and adequately protected against theft?

Is the warehouse well-lighted? Are the windows painted or covered to protect foods from direct sunlight?

Is the warehouse adequately equipped with fire protection and alarm systems? With burglar alarm systems?

Is the dry storage space properly ventilated to assist in controlling temperature and humidity?

Are refrigeration units adequate for maintaining the required temperatures in "normal" refrigeration and in "freezer" or frozen food storage?

Are facilities provided to segregate foods that absorb odors from those that give off odors?

Is a separate area available for storing items other than food?

Are provisions made for following good housekeeping practices to insure cleanliness and orderliness?

Are foods subject to insect infestation stored in separate sections of the warehouse?

Are sanitary handwashing and restroom facilities available?

Is the warehouse properly constructed and are adequate facilities provided to assure protection against moisture, heat, or freezing damage to foods?

Part II—INSPECTION AND RECORDS

Inspection of Foods Upon Arrival at Warehouse or Distribution Points

Prior to acceptance from carrier (whether by railway car or truck) each shipment should be carefully checked for possible shortages and damage before the foods are placed in the warehouse.

Refrigerated products should be examined upon arrival to be sure that temperatures are adequate and that the products are in good condition. This is very essential for frozen products. All refrigerated foods should be moved promptly in refrigerated trucks or refrigerated rail cars. On short hauls, if refrigerated transportation cannot be provided, the product should be stacked close together, covered with tarpaulin and moved promptly.

Canned foods should be examined to determine if there are any damaged, disfigured, or discolored cases or cans which might indicate spoilage or deterioration of the product.

Foods subject to insect infestation should be thoroughly examined. Even though foods are free of infestation when they leave the shipping point, they may arrive badly infested due to the use of an infested freight car or truck.

Foods that are found to be out of condition at time of receipt should be recorded and segregated from other foods.

Salvage of Partially Out-of-Condition Foods

It is often possible to salvage foods when spoilage has not reached an advanced stage of decomposition, infestation, or contamination. Salvage may mean sorting the good foods from the bad and using the good foods immediately or storing them at lower temperatures. In other instances, it may be necessary to reprocess the products; for example, rice may be recleaned and rendered suitable for use.

Foods reclaimed by fumigation should not be issued for human consumption until a sampling of the foods has been analyzed by and written approval has been received from State or local public health authorities certifying that the samples examined are fit for human consumption.

Ample equipment should be on hand for reconditioning and repackaging of damaged sacks and containers.

Disposal of Food Containers

All used containers and sacks should be removed from the warehouse and disposed of in accordance with the provision of the Federal-State distribution agreement.

Records

It is essential in all warehousing operations to have accurate information on the amount of foods in stock, warehouse location of the foods, and quantities of foods handled into and out of the warehouse over given periods of time. Methods used to maintain this information will depend on whether automatic tabulating equipment or manual methods are used.

Prompt and accurate checking and recording of inbound shipments of food are essential. Each shipment received should be recorded on a prescribed agency receiving report or receipt document showing such information as the date, type and quantity of food received, and the warehouse location. Any shortages in the shipment should be promptly reported.

In addition, it is essential that the warehouse manager record each outbound shipment, indicating such information as date, type and quantity of food removed, along with the name of the shipper and recipient. Invoices for shipping foods should be kept on file.

A physical count of each food in storage should be made each month and balanced against the receiving and distribution reports to determine if there is any overage or shortage.

Shown below is a sample ledger sheet which provides for the minimum information needed to establish food control and which may be adjusted to fit the record requirements of most warehouses:

FOOD ---------- UNIT ---------- WAREHOUSE LOCATION ----------

DATE	DESCRIPTION OF RECEIPT OR REMOVAL	QUANTITY RECEIVED	QUANTITY REMOVED	BALANCE ON HAND

The information shown under the "Description of Receipt or Removal" column should identify and refer to the documents (bills of lading, delivery orders, delivery receipts, distribution schedules, inventory adjustments, records of losses, etc.) which authorize, confirm, and/or explain the receipt or removal of the quantity of foods shown opposite the appropriate entry. These documents should be identified with the entries to which they apply and held in the warehouse files.

Major Points to Consider on Inspection and Records

Are shipments of incoming foods examined for damage and other evidence of poor handling and for insect infestation?

Are all incoming foods checked for quantity and recorded as to quantity, warehouse location, and date?

Are proper steps taken to salvage partially out-of-condition foods?

Are used containers and sacks disposed of in accordance with the Federal-State distribution agreement?

Are adequate records maintained on foods in storage and on foods shipped?

Are all food shipments checked for accuracy of assembly?

Are all receipt and delivery documents properly checked and signed?

Part III—EFFECTIVE USE OF WAREHOUSE SPACE

Warehouse Layout

A good warehouse layout involves the effective use of all three dimensions of the facility—length, width, and height—to permit efficient use of labor and materials-handling equipment in receiving, storing, and shipping the foods. Effective use of the third dimension—height—will more than compensate for the additional aisle space required with the use of forklift trucks.

The layout of the warehouse is dependent on the type of materials-handling equipment to be used. With use of conveyor lines and handtrucks, the warehouse aisles can be narrower than when forklift trucks are used. At the same time, it is more difficult to use height with handstacking methods. In buildings with low ceilings, it is usually preferable to use a conveyor or handtruck system. A conveyor system is preferable to a handtruck system in warehouses of less than 30,000 square feet in size.

It is essential in laying out the warehouse to have an orderly flow of foods into, within, and out of the buildings. Foods should not be double-handled or moved from one storage point to another within the building. Greater use of space is achieved when foods face parallel to the aisle rather than at a 45 degree angle. Both main and cross aisles should be wide enough to avoid congestion and permit use of materials-handling equipment.

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Figure 3.—Foods stacked and facing parallel to the aisle.

In locating foods in the warehouse, the fast moving and heavy foods should be placed near the shipping dock to reduce the amount of travel distance required to assemble orders. Slower moving and lightweight foods should be placed toward the rear of the warehouse. New shipments of foods should always be stored behind the older shipments to facilitate removal of old stocks first. This "first-in, first-out" practice should be followed in the distribution of all donated foods.

Floor Load Limits

The materials-handling system to be used in a warehouse is frequently decided on the basis of floor load limits. Forklift trucks are heavy and their weight added to that of the

loads handled may create an overload, whereas neither the machine nor the load itself would over-burden the floor. It is necessary to use handtrucks or conveyor lines when this situation is found.

Having obtained the floor load limit from an approved State or local safety engineer or building inspector, it is possible to compute the height to which various kinds of foods can be stacked with the following procedure:

Lay out the first tier of foods in the manner they are to be stacked. Measure the square foot area of the first tier as laid out, including the aisle. Multiply the approved per-square-foot safe floor load by the number of square feet in the area laid out. The result will be the total pounds of safe floor load for the area. Divide this total allowable weight for the area by the gross weight of each case or bag of the food to be stacked. The result will be the maximum number of cases or bags that can be piled in the area.

Example: The "safe floor load" is 90 lbs. per square foot, and bags weighing 100 lbs. each are to be stacked. The area of the stack, including aisle space, is 4 feet by 4 feet, or 16 square feet. Multiplying 16 (the number of square feet in the area) by 90 (the number of lbs. of safe floor load per square foot) equals 1440, the number of pounds that can be safely stacked in the area. Dividing 1440 by 100 (weight of each container) equals 14, which is the number of containers that can be piled in the area within the safe floor load limit.

In most modern one-floor warehouses, with high ceilings and concrete floors, restrictive load limits are seldom encountered in storing foods.

Palletizing Foods

Generally, pallets are made from selected hardwood lumber, 2″ x 4″ and 1″ x 4″ or 1″ x 6″ in size. Wooden members are put together with special cement-coated, drive screw-type pallet nails hand-driven into frames. When power fork or hand pallet trucks are used in the warehousing operation, pallets must be provided. The pallet serves as the base upon which cases of canned goods or sacks of flour, cornmeal, and other foods are stacked. The pallet also provides an entrance for the fork truck prongs to engage and lift the load. Two pallet sizes, 32″ x 40″ and 48″ x 40″, are recommended standards for the food industry today. The following illustrations show the types of pallets used in handling food products:

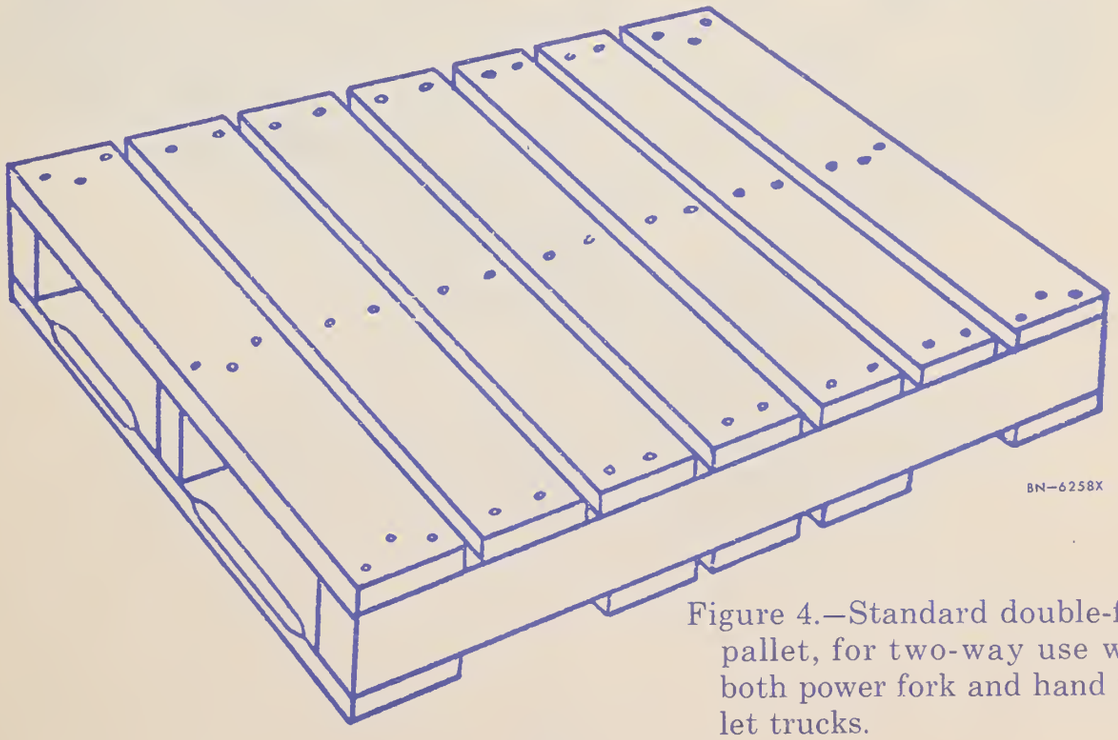


Figure 4.—Standard double-face pallet, for two-way use with both power fork and hand pallet trucks.

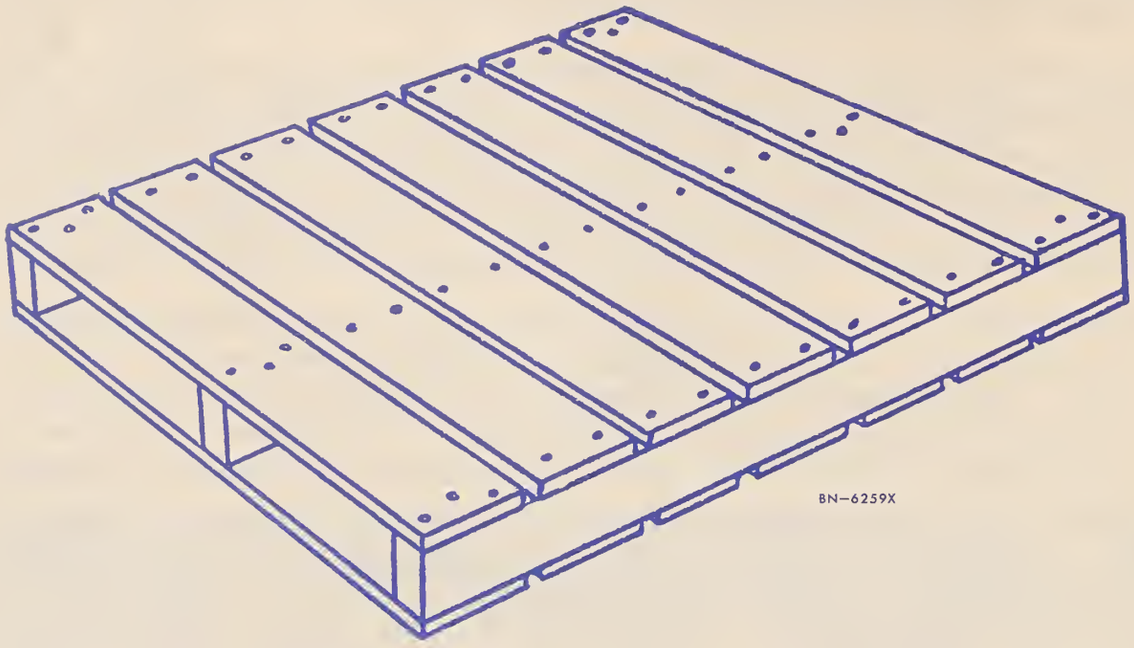


Figure 5.—Reversible double-face pallet, for two-way use with power forklift truck.

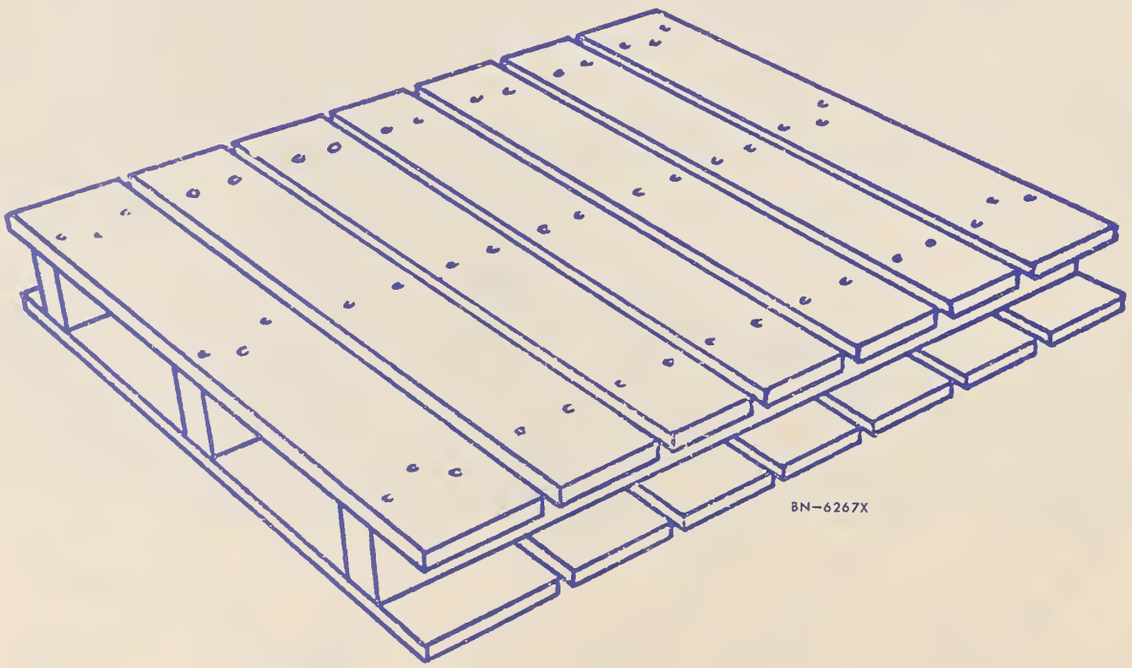


Figure 6.—Stevedore pallet, for use with bar slings as well as power forklift trucks. A special purpose pallet, usually built to specifications. Bolted or nailed.

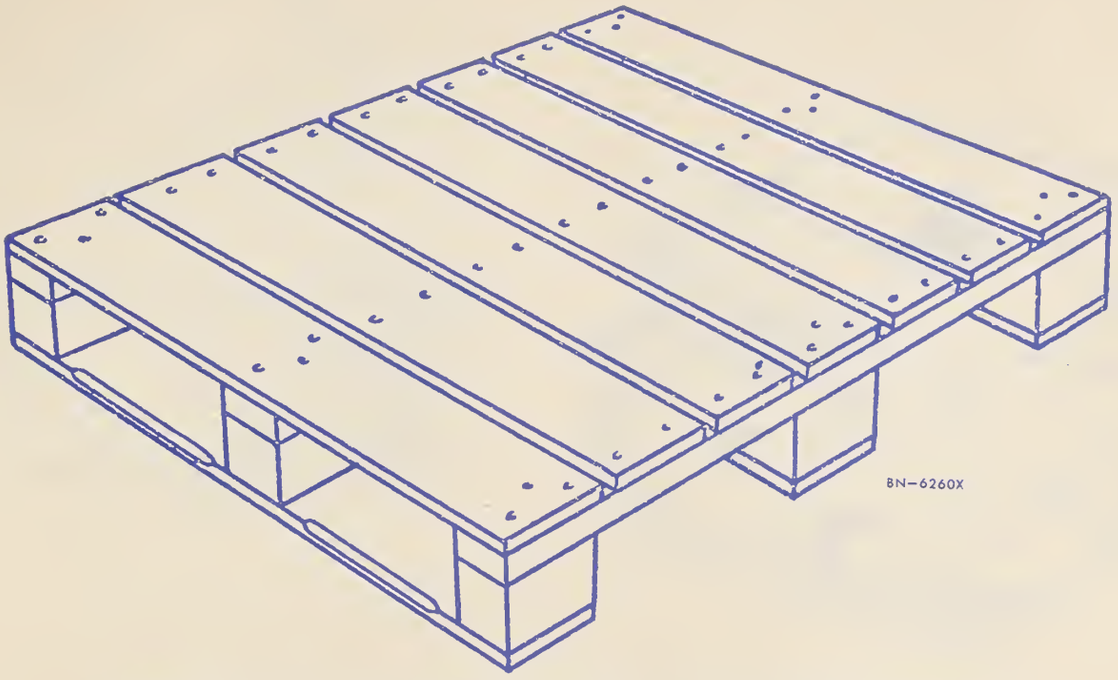


Figure 7.—Four-way post-type pallet, can be handled from any side with power forklift or hand pallet truck.

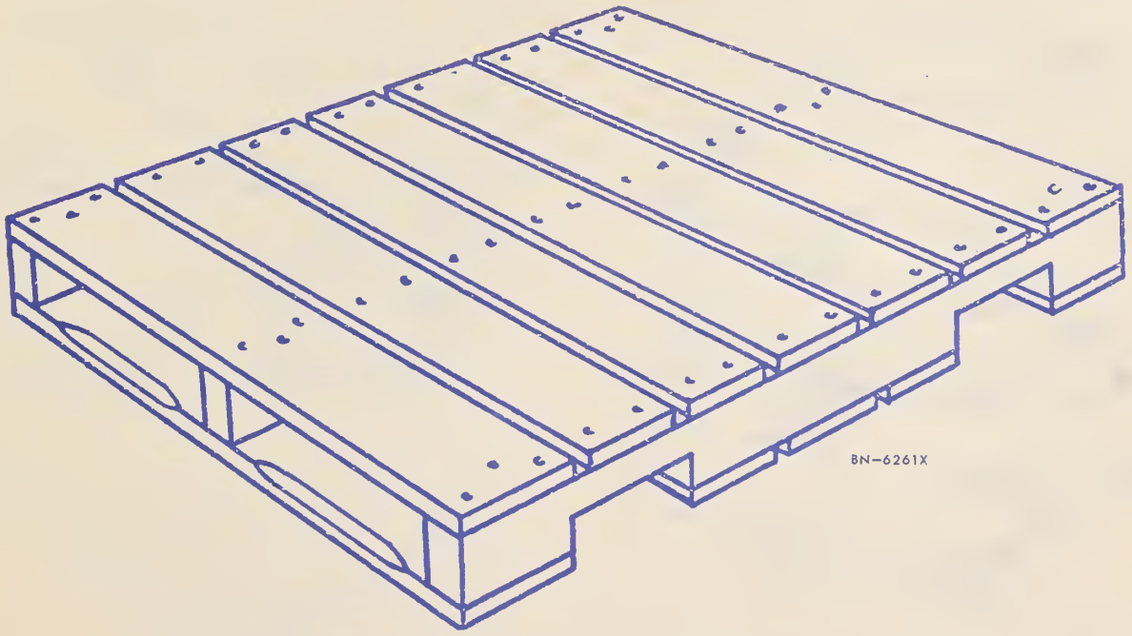
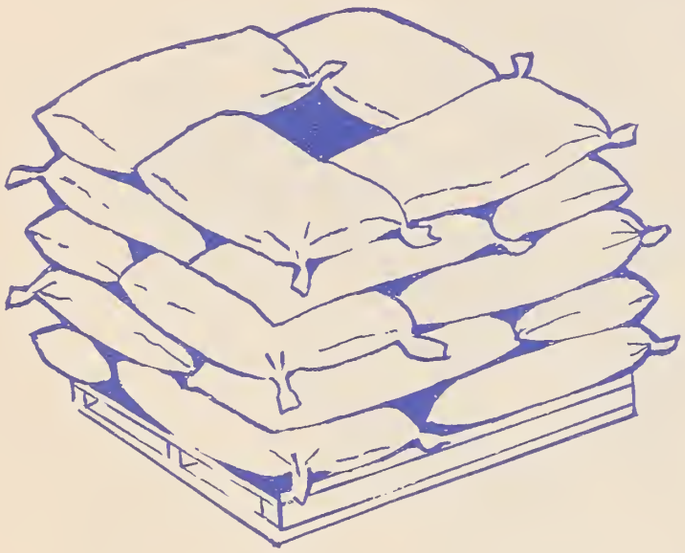


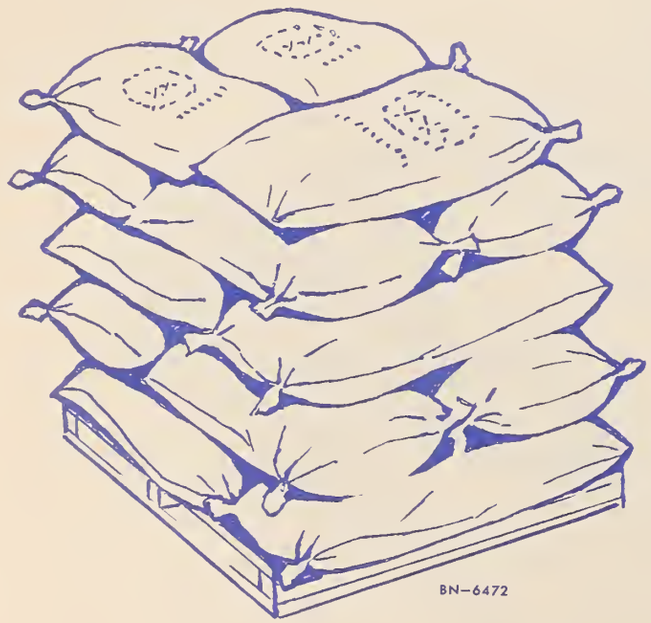
Figure 8.—Four-way cut stringer pallet, for four-way handling with power forklift truck and two-way handling with hand pallet truck.

The arrangement of cases or bags within a stack influences the safety of handling palletized foods with power equipment and the stability of high-piled foods. When foods are to be piled high, it is essential that the cases or bags be "tied in" or "locked." Examples of correct methods of stacking are shown in the following illustrations:



Completed Chimney-style Stacking of 50 lb. bags:

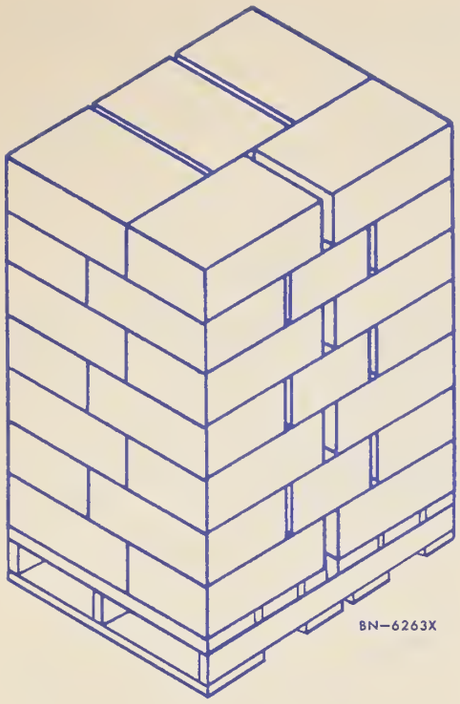
Bags per tier	4
Tiers	5
Bags per load	20
Weight per load	1000 lbs.



Completed Lock-style Stacking of 100 lb. bags:

Bags per tier	3
Tiers	5
Bags per load	15
Weight per load	1500 lbs.

Figure 9.—Methods of stacking bags of flour, rice, cornmeal, beans, etc. on 48″ x 40″ pallets.

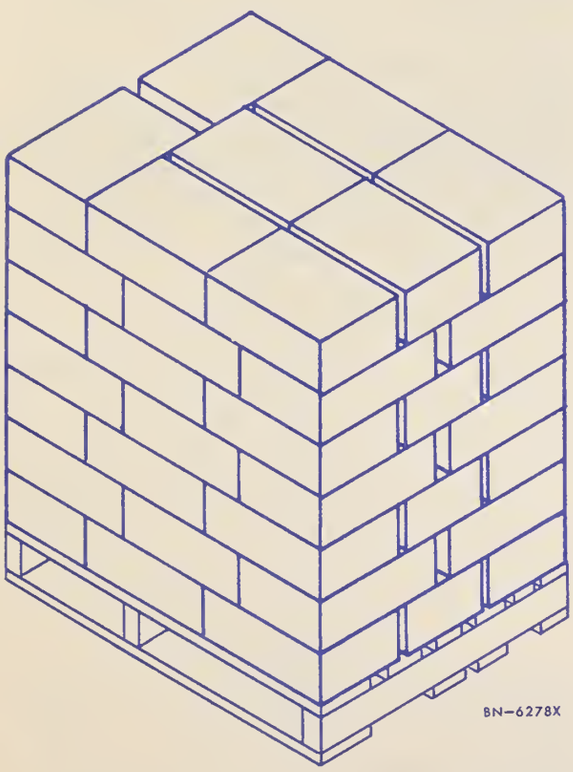


Can size ..... No. 10
Cans per case 6

Size of case ..... 19″ x 12¾″ x 7¼″
Weight per case ..... 49 lbs.

Pallet size ..... 32″ x 40″

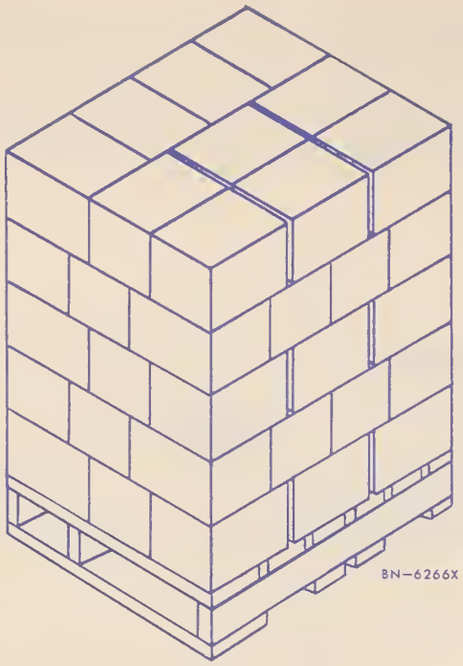
Cases per tier 5
Tiers 7
Cases per load 35
Weight per load ..... 1715 lbs.



Pallet size ..... 48″ x 40″

Cases per tier 8
Tiers 7
Cases per load 56
Weight per load ..... 2744 lbs.

Figure 10.—Methods of stacking cased No. 10 canned goods on different-sized pallets.

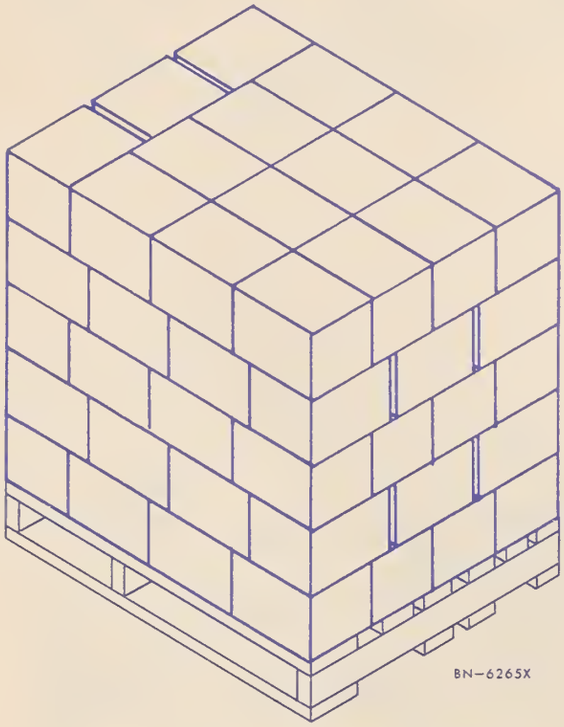


Can size ..... No. 303
Cans per case 24

Size of case ..... 13″ x 9¾″ x 9″
Weight per case ..... 30 lbs.

Pallet size ..... 32″ x 40″

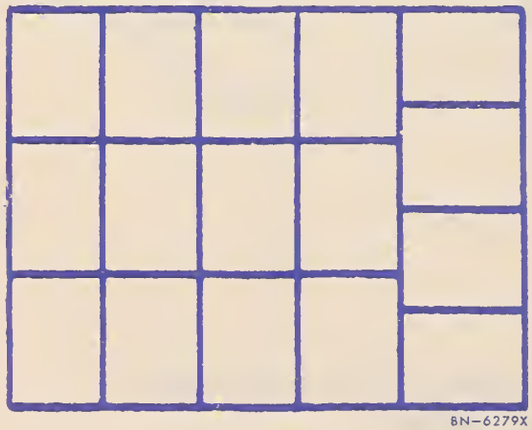
Cases per tier 10
Tiers 5
Cases per load 50
Weight per load ..... 1500 lbs.



Pallet size ..... 48″ x 40″

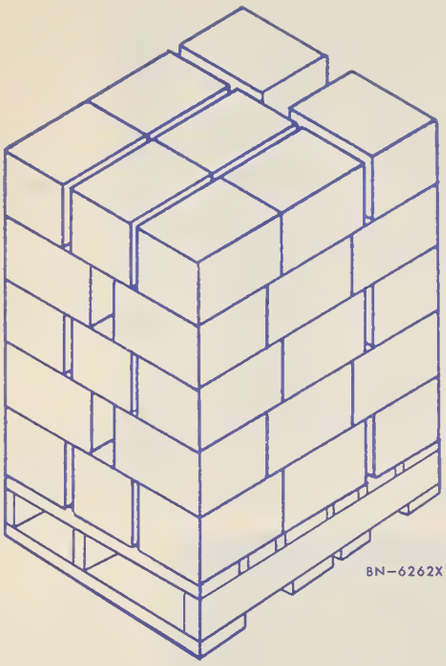
Cases per tier 15
Tiers 5
Cases per load 75
Weight per load ..... 2250 lbs.

ALTERNATE LOAD PATTERN



Cases per tier 16
Tiers 5
Cases per load 80
Weight per load ..... 2400 lbs.

Figure 11.—Methods of stacking cased No. 303 canned goods on different-sized pallets.

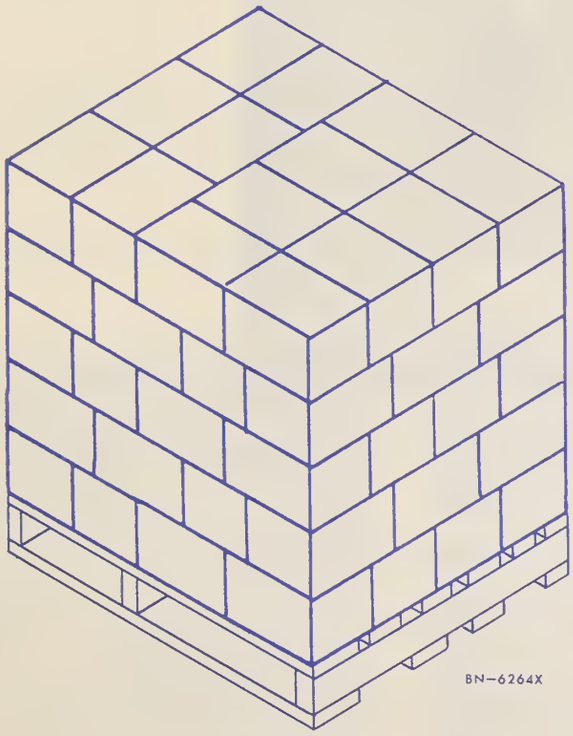


Can size ..... No. 2
Cans per case 24

Size of case .... 14" x 10½" x 9¼"
Weight per case ..... 38 lbs.

Pallet size ..... 32" x 40"

Cases per tier 8
Tiers 5
Cases per load 40
Weight per load ..... 1520 lbs.



Pallet size ..... 48" x 40"

Cases per tier 14
Tiers 5
Cases per load 70
Weight per load ..... 2660 lbs.

Figure 12.—Methods of stacking cased No. 2 canned goods on different-sized pallets.

Figure 13.—Completed stacking of sacked and baled foods

Figure 14.—Completed stacking of cased and baled foods.

Major Points to Consider in Effective Use of Warehouse Space

Is the warehouse planned for efficient use of floor area and height?

Is the floor load limit considered in determining the heights of the stacks?

Is the proper materials-handling equipment being used for the type of warehouse?

Are high-piled foods "tied in" or "locked" for safe handling?

Are stacks of high-piled foods stable?

Are new shipments of foods stored behind the older shipments to facilitate removal of old stocks first?

Is a "first-in, first-out" policy followed in the distribution of all donated foods?

Part IV—EFFICIENT USE OF EQUIPMENT

Materials-handling equipment, hand- or mechanically-operated, provides the tools for efficient handling and storing of foods. A determination as to what types should be used in a particular warehouse will depend on the kinds and volume of foods that will be handled, and what type and size of warehouse building will be used.

Hand Equipment

Hand equipment used in warehousing includes the 2-wheel handtruck, the 4-wheel handtruck, low lift pallet jacks, dollies, and skids.

Studies conducted by AMS Marketing Research teams [1] showed that with use of 4-wheel handtrucks, production is 37 percent greater per man-hour than with use of 2-wheel handtrucks.

The 2-wheel handtruck is used extensively in small warehouses. It has the following advantages: (1) low initial cost, (2) low maintenance cost, (3) narrow warehouse aisles can be used, (4) can be used for both receiving and shipping operations. Its main disadvantage is that only a limited amount of weight and bulk can be handled per trip.

The 4-wheel platform truck has advantages 1, 2, and 4 enumerated above, plus the additional advantage of carrying about 3 or 4 times as much weight and bulk per trip as the 2-wheel handtruck.

[1] Marketing Research Report No. 94, USDA, AMS, June 1955 and Marketing Research Report No. 142, USDA, AMS, Nov. 1956.

Figure 15.—Two-wheel handtruck.

Figure 16.—Four-wheel handtruck.

Manually-operated low lift pallet jacks are useful in warehouse operations for handling pallets shown in Part III, Efficient Use of Warehouse Space.

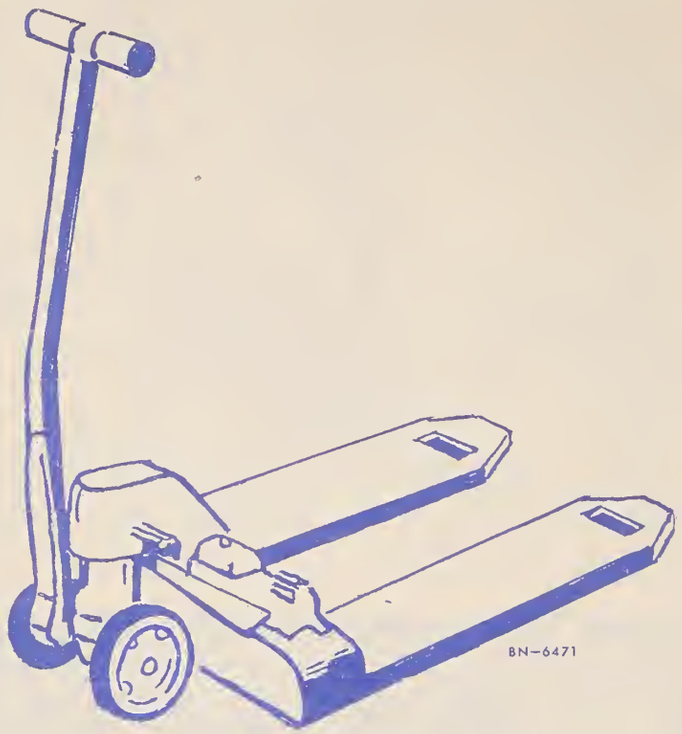


Figure 17.—Manually-operated low-lift pallet jack.

The main use for dollies is in receiving foods. This is an excellent means for moving a loaded pallet from the railcar or tailgate of the truck to a convenient area where it can be picked up by a forklift truck. The pallet should be placed on the dolly before palletizing foods.

Figure 18.—Open frame dolly.

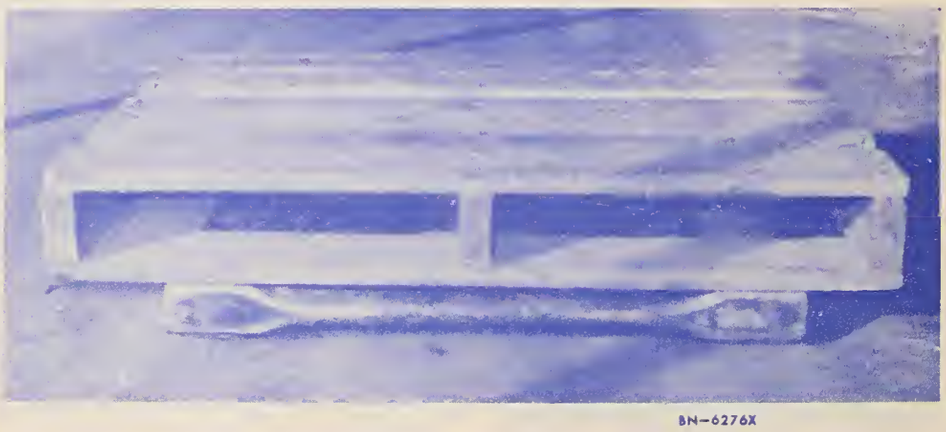


Figure 19.—Pallet placed on dolly.

Semi-live skids may be used for storing foods and for moving palletized or hand-stacked foods out of railcars or trucks for later removal with a forklift truck. Semi-live skids are operated by the use of a lift jack. Foods can also be assembled for shipment on semi-live skids.

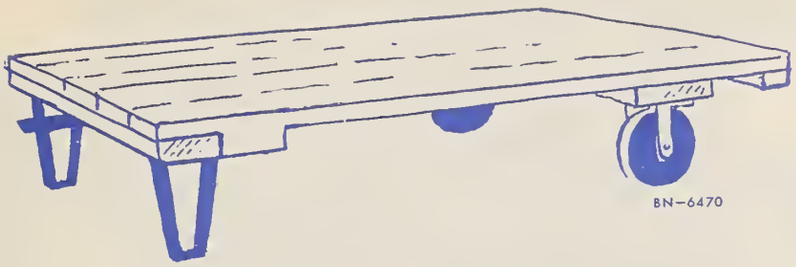


Figure 20.—Semi-live skid.

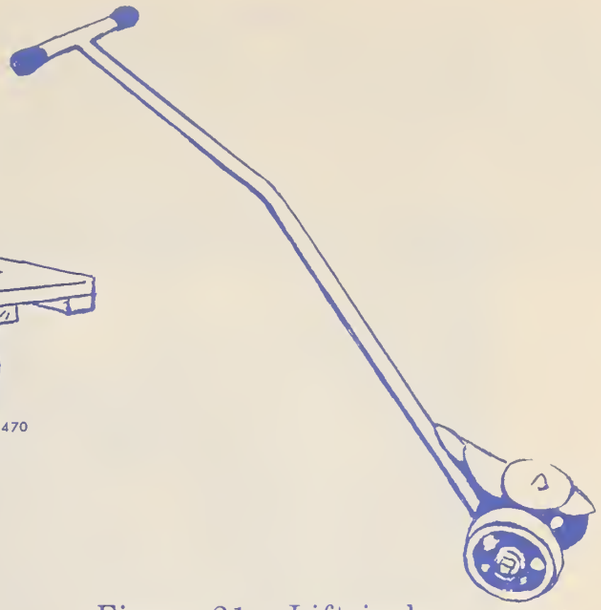


Figure 21.—Lift jack.

Mechanical Equipment

Mechanically-operated equipment includes forklift trucks, tow tractors, conveyor lines, and elevators.

Forklift trucks are designed for warehouse operations where: floors are of concrete, operations are carried on over an extensive area, floor load limits are not too limited, and wide aisles may be utilized. Forklift trucks have the following advantages: (1) speeds of 5 to 6 miles per hour with a 4,000-pound load, and (2) can be used to stack foods vertically up to 200 inches. Counter-balanced forklift trucks operate in aisles 9 to 10 feet wide. Straddle-type forklift trucks operate in aisles 6 to 7 feet wide. Counter-balanced trucks perform a speedier operation because vertical lifts of loads can be performed simultaneously with forward motion of the truck. This is not true for the straddle-type truck.

Figure 22.—Straddle-type forklift truck.

Figure 23.—Counter-balanced forklift truck.

Tow tractors are designed for operation in large warehousing facilities. They have the following advantages: (1) may be used to tow as many as four or five 4-wheel trucks about the warehouse while an order is being assembled; (2) travel with a full load at a speed faster than a man normally walks; (3) may be used on a 24-hour schedule with gasoline models, or with electric models provided an extra battery is available while the original battery is being recharged; and (4) increased order filler productivity (work done per man-hour) because of reduction of travel time over the warehouse.


BN-6468

Figure 24.—Tow tractor to move foods within the warehouse.

Based upon total warehousing operation, a conveyor system is the most efficient materials-handling tool in multistory warehouses. Conveyor systems are used extensively for order assembly as well as for receiving operations. The two basic types are wheel and roller. Both perform satisfactorily in warehouses. Advantages of a conveyor system include: (1) reduced travel over the warehouse when selecting foods for shipment; (2) increased use of floor space because narrower aisles can be used than when power equipment is utilized; (3) may be used in buildings with floors too weak for a forklift operation; and (4) may be used to link together separate buildings or different floors within one building. Basically, the use of conveyors is economically justified for warehouses up to 30,000 square feet in size.


BN-6274X

Figure 25.—A wheel conveyor gravity line. Moves foods to stacking area or to delivery trucks.


BN-6273X

Figure 26.—A roller conveyor gravity line. Moves foods on to an endless belt conveyor.

The endless belt conveyor is used in conjunction with both wheel and roller conveyor systems to re-elevate foods to provide the necessary downgrade. The belt is also used to move foods between floors. Roller or wheel conveyors are frequently used within railcars or trucks to move foods to unloading platforms and frequently to connect with the main conveyor line moving the foods to the storage point.

BN-6269X

Figure 27.—An endless belt mechanized conveyor and wheel conveyor, used for the truck loading operation. Endless belt conveyor serves to re-elevate foods for gravity flow to loading point.

In multistory warehouses, elevators as well as endless belt conveyors may be used to move foods between floors. The type of facility used will depend upon the volume of foods handled and the number of floors. Elevators are generally used in large warehouses (more than 30,000 square feet).

BN-6270X

Figure 28.—A type of elevator used in a multistory warehouse. The operator rides with the load between floors.

Major Points to Consider in Efficient Use of Equipment

What types of materials-handling equipment will be needed for the kinds and volume of foods that will be handled?

Is materials-handling equipment suited to the warehouse size?

Has an analysis of the operation been made to determine if mechanical equipment would be justified?

Have floor load limits been considered?

Have warehouse personnel been properly trained in the use of materials-handling equipment?

Part V—EFFICIENT USE OF LABOR

Studies conducted by AMS Marketing Research teams show that labor accounts for more than 50 percent of total warehousing costs. Therefore, methods of increasing labor productivity (work done per man-hour) should be of major concern to warehouse management.

Receiving Foods

Increased labor productivity can be achieved in receiving foods by using the following principles: (1) separating the palletizing operation from the storing operation; (2) improving work crew balance; and (3) reducing the number of workers assigned to a particular operation.

By separating the palletizing operation from the forklift storing operation, the study showed, nearly 13 percent of the man-hours in receiving merchandise was eliminated. Improved work crew balance in receiving merchandise by conveyors saved 15 percent of the total receiving time in railcar and motor-truck unloading. On a production per man-hour basis, productivity of one man in palletizing merchandise in a railcar was nearly 38 percent greater than two men working as a team, and a two-man team produced 38 percent more than a four-man team.

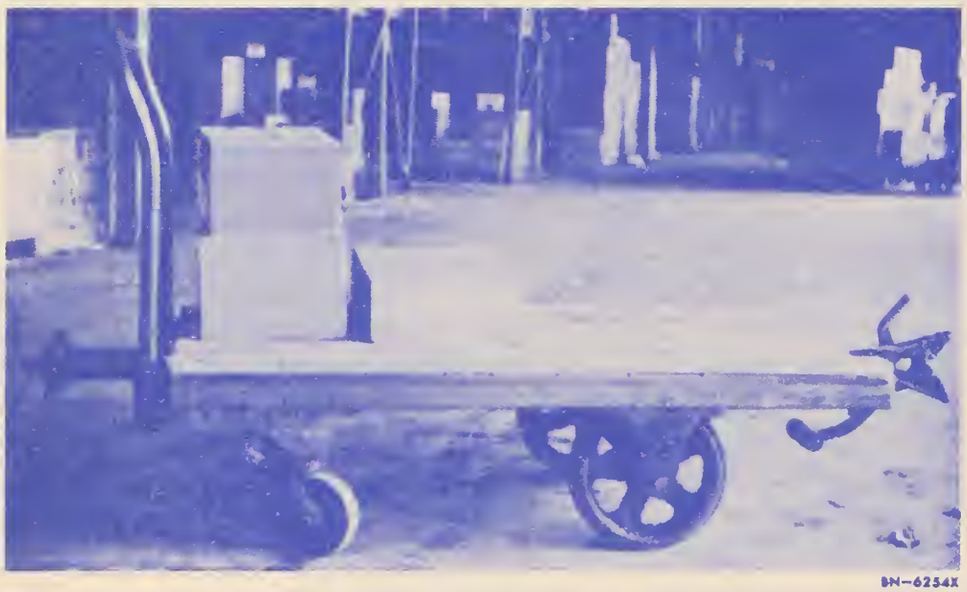
Figure 29 illustrates misuse of the following principles: (1) separating the palletizing operation from the storing operation—forklift operator is idle while waiting for the unloading crew to finish a pallet; (2) improving work crew balance—three men stacking cases cannot keep up with one forklift operator storing the pallet load; and (3) reducing the number of workers assigned to a particular operation—the three men are working too close together and one man is sitting down on the job. A more efficient operation would result if the three unloaders were each given a railcar to work individually, with the forklift truck servicing all three.

Figure 29.—Inefficient use of labor.

Filling Orders

Labor productivity in order selection is affected by: (1) delay time; (2) order size; (3) type of order assembly system; and (4) materials-handling equipment.

Delay factors materially affecting order filler production include: improper crew balance, waiting for orders, waiting for selector trucks, hunting for a specific item, doubling back over the same routes in the assembly of a given order, waiting for a conveyor line to be cleared of orders assembled on it, and waiting for merchandise to be brought from reserve storage. The AMS study showed that order fillers averaged 82 cases per man-hour on orders of 1 to 10 cases in size, while they averaged 201 cases per man-hour on orders larger than 75 cases. With 4 types of order assembly systems, productivity of order fillers ranged from 57 to 137 cases per man-hour in the assembly of a 30-case order. For a discussion of materials-handling equipment see Part IV, Efficient Use of Equipment.



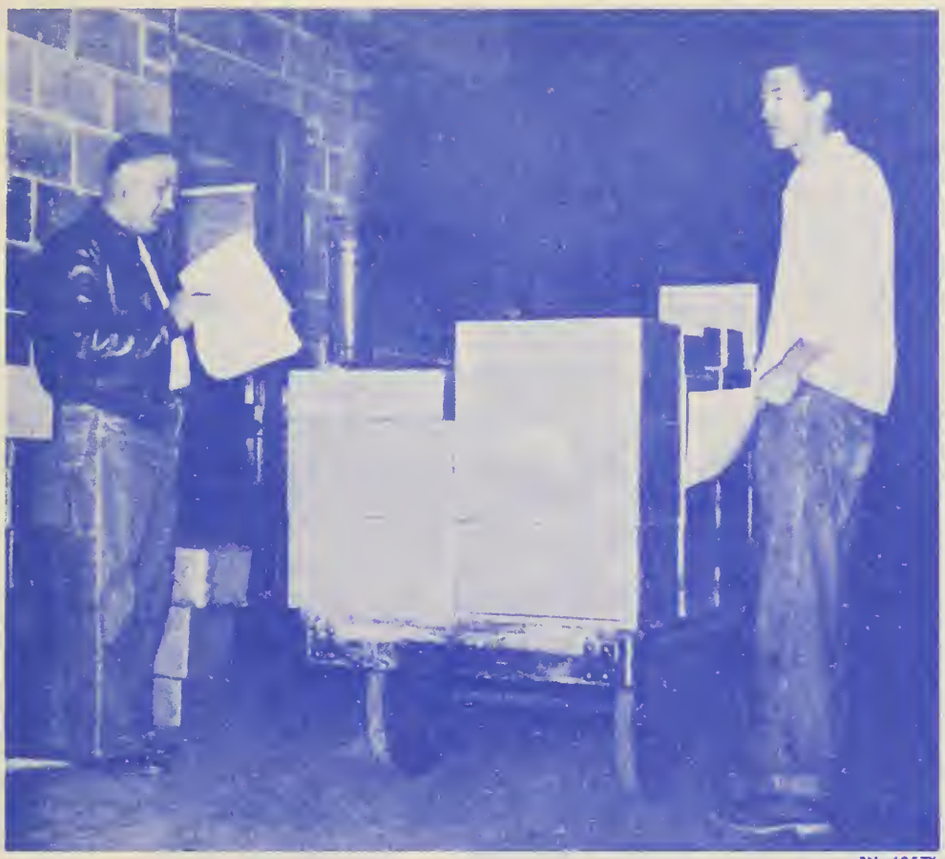
A 3-case order
Time required for assembly—4.52 minutes.
Assembly rate—40 cases per hour.

Part of a 110-case order
Time required for assembly—36.64 minutes.
Assembly rate—180 cases per hour.

Figure 30.—The effect of order size on productivity.

Checking Orders

The principle of reducing the number of persons doing similar work applies to the checking operation also. By having order fillers arrange the foods on 4-wheel selector trucks as they assemble the order, and having orders checked by one man rather than a 2-man team, checking labor can be reduced 50 percent.



Two men checking an *unarranged* order assembled on a 4-wheel handtruck.

One man checking an *arranged* order on a 4-wheel handtruck.

Figure 31.—**The effect of order arrangement on labor requirements.**

The AMS study showed that the productivity of 2 order checkers working as a team was increased nearly 38 percent, from 502 to 692 cases per man-hour, when orders were arranged on the 4-wheel truck. To arrange orders on a 4-wheel truck, order selectors placed the first half of the items on one side of the truck and the remainder on the other side, thus eliminating the necessity of searching for each item on both sides of the truck as the order was being checked.

When one man checked orders, production per man-hour was increased nearly 75 percent, from 692 cases to 1,208 cases per man-hour, over having two men check as a team. When two men check unarranged orders as a team, one man calls the item, the other marks the appropriate case. With this system, delay time occurred while one man was hunting for the item and in waiting for the other man to call the next item. By having each man work individually, these delays were eliminated, resulting in increased production.

Loading Foods

In the loading of delivery trucks, one man handles approximately a third more cases per man-hour than two men working as a team. The reasons two men working as a team produce less on a production per man-hour basis include: (1) only one man is usually required in most instances to unload the 4-wheel handtruck; and (2) team members get in each other's way in close quarters.

In actual practice there is also a tendency for the team to adapt its rate of work to that of the slower member and the team members spend a considerable amount of time visiting. The AMS study showed conclusively that one man working alone is more productive except when heavy foods such as 100-pound sacks of beans or flour are handled in volume. In these instances, a two-man team is more productive.

Figure 32.—Use of dock board for railcar unloading.

When foods are placed on conveyors during order selection in the warehouse, greater productivity of truck loading labor is obtained when the conveyor is extended into the delivery truck. This method eliminates double handling of the foods from the end of the conveyor line into the delivery truck.

A dock board should be used between loading dock and truck or railcar for improved efficiency.

Major Points to Consider in Efficient Use of Labor

Is there a more efficient way of doing a job?
Are there too many workers on the job?
Is the work crew properly balanced?
Have the warehousing jobs been analyzed for delay time?
Is a one-man work unit used wherever possible rather than a team of two or more workers?
Are dock boards used between loading dock and truck or railcar?
Has the labor force been properly trained for the job?

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